Final Contractor Report #7

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Physics of Boundaries and their Interactions in Space Plasmas

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I. Large Scale Simulation of the Magnetopause:

We are extending our previous large scale simulations of the bow shock by replacing the flow obstacle by a line dipole. The proper imposition and treatment of the dipole field in the 2-D code is a difficult problem. Currently, we are evaluating the numerical aspects as well as physical effects of imposing a dipole field at the start of the simulation versus creating a dipole field slowly in time. At the same time, we have tested several different boundary conditions in order to avoid the pile up of the magnetic field in the 2-D simulations.

II. Reconnection Geometry at the Magnetopause:

We used our newly developed 2-D Darwin code to examine the saturation amplitude of the guide field tearing mode in the magnetopause. Since it is crucial to use high mass ratios for this problem, we are running the code on the Cray T3D. The sheer size of the simulation box puts the simulations out of reach of serial machines. We are also working on imposing inflow-outflow boundary conditions in the 2-D hybrid code in order to examine the kinetic structure of the reconnection geometry at the magnetopause. Our simulation model will take into account the asymmetries in the plasma and field conditions in the agnetosphere and the magnetosheath. This is a prelude to our 3-D hybrid simulations that we plan to perform in the near future.

III. Large-Scale Hybrid Simulations of the Magnetotail:

In our study of the near-Earth reconnection and its consequences we are continuing our efforts in characterizing the ion phase space earthward of the reconnection line, subsequent to reconnection onset, and exploring the role ionospheric oxygen ions may play in the near tail current sheet thinning. To this end we have begun to work on incorporating minority ions into the hybrid simulations. We have also started to summarize our previous near-Earth reconnection results in preparation for a publication in Journal of Geophysical Research.

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13. ABSTRACT (Maximum 200 words)

This report describes the work done by SciberNet, Inc. during the month of May. We are continuing our work on the large scale hybrid simulations of the magnetopause. Specifically, we are evaluating the physical as well as numerical differences in imposing a dipole field at the start of the simulation as opposed to turning it up slowly in time. We also used our 2-D Darwin code to make a large run on the parallel machine CRAY T3D. The objective is to determine the saturation amplitude of the guide field tearing mode at the magnetopause. We are also in the process of extending our large scale simulations of the magnetotail to the magnetopause. To this end, we are in the process of implementing the inflow-outflow boundary conditions in the 2-D hybrid code, accounting for the asymmetries in the field and plasmas at the magnetosheath and the magnetosphere. Finally, we have continued our work on with regard to near-Earth reconnection.

14. SUBJECT TERMS

Foreshock, bow shock, magnetotail, reconnection, kinetic simulations

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